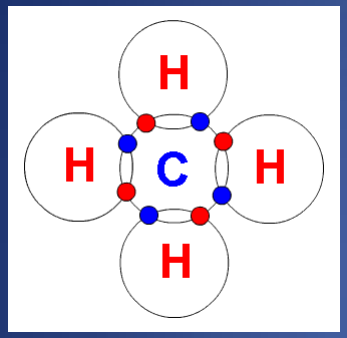
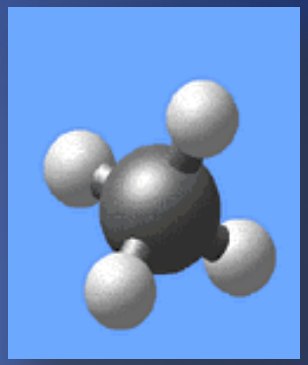
Pat Riley

-Gibson County Utility District & TPGA-

The Natural Gas Opportunity



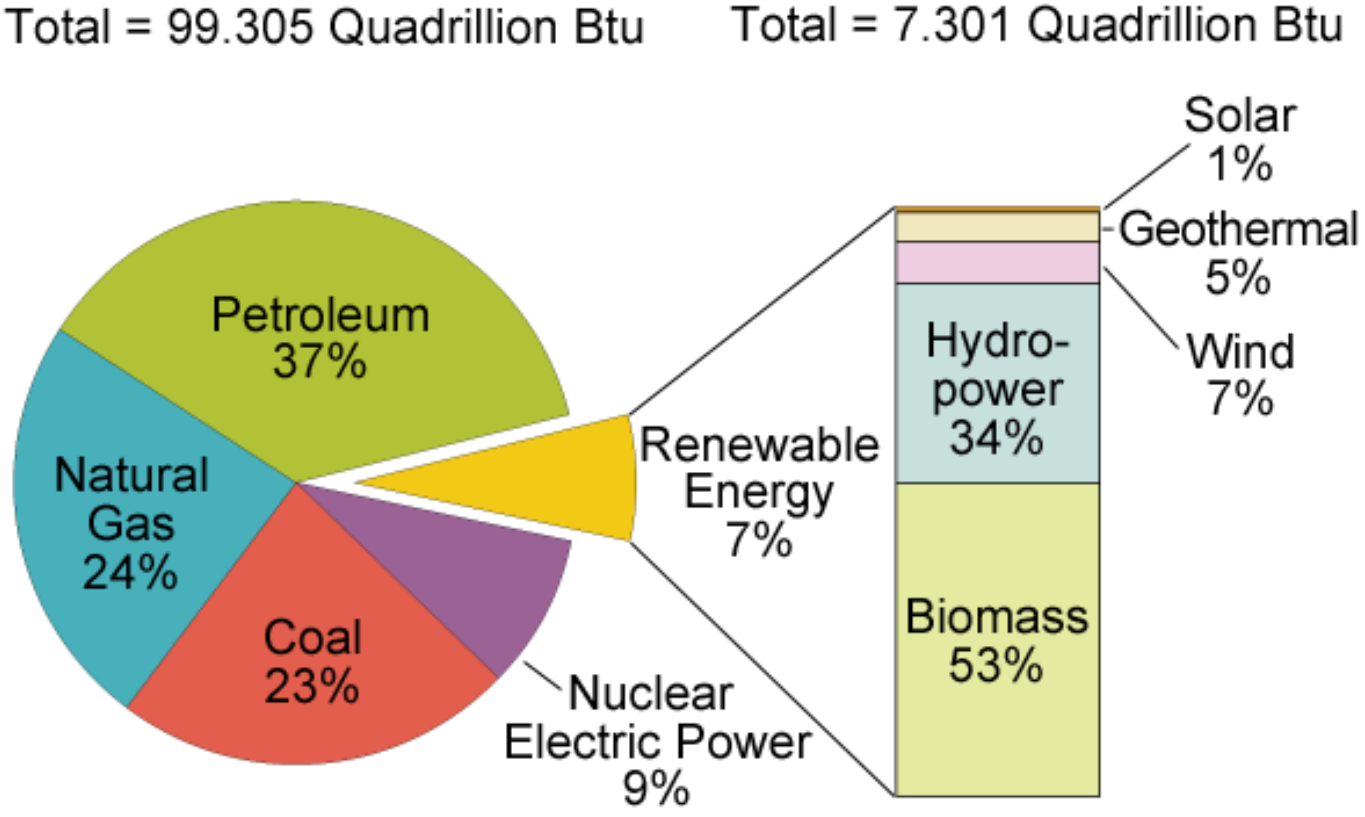
CH_4



Natural Gas (Methane)

The Cleanest Burning Fossil Fuel On The Planet

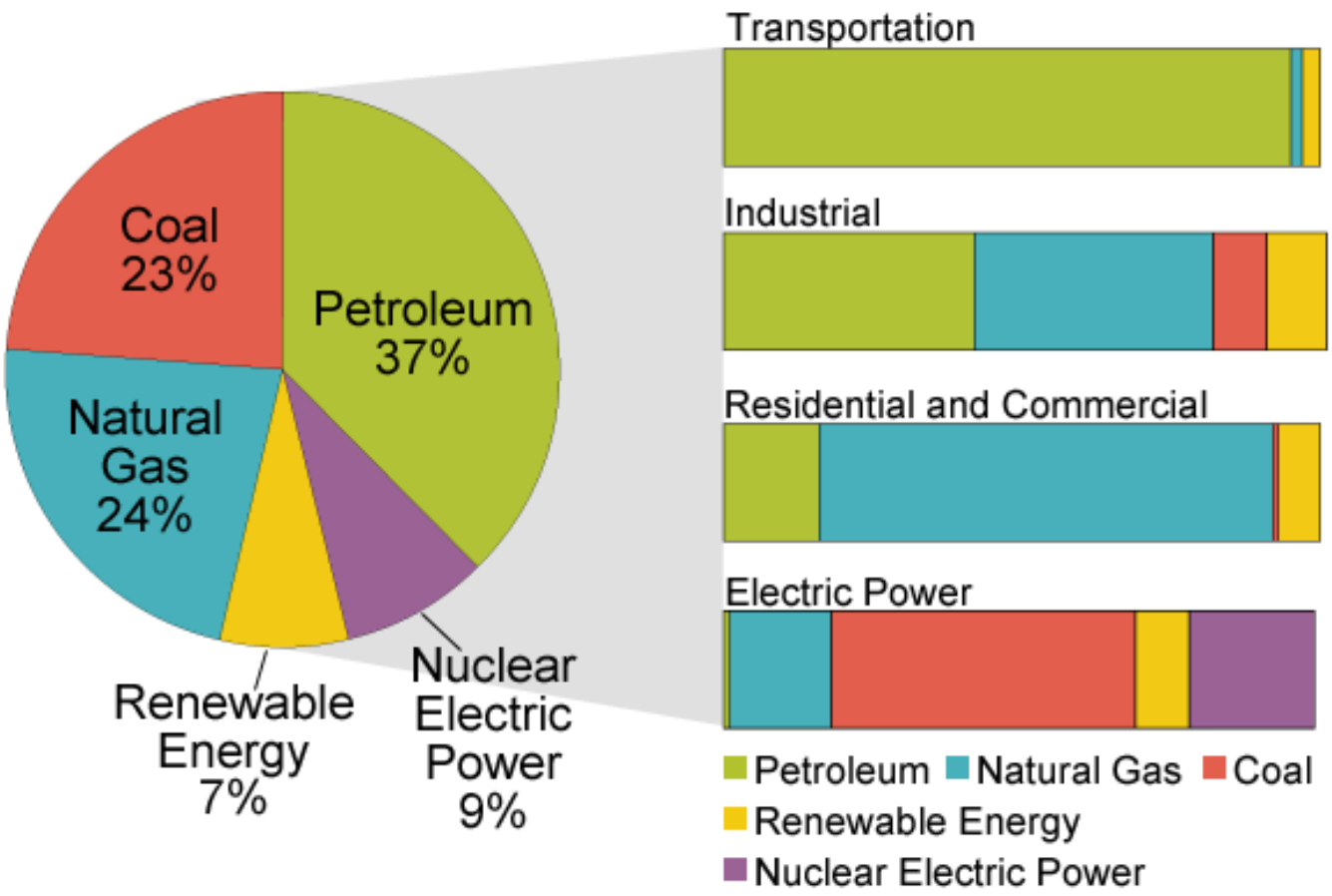
U.S. Energy Consumption by Energy Source, 2008



Note: Sum of components may not equal 100% due to independent rounding.

Source: EIA, *Renewable Energy Consumption and Electricity 2008 Statistics*, Table 1: U.S. Energy Consumption by Energy Source, 2004-2008 (July 2009).

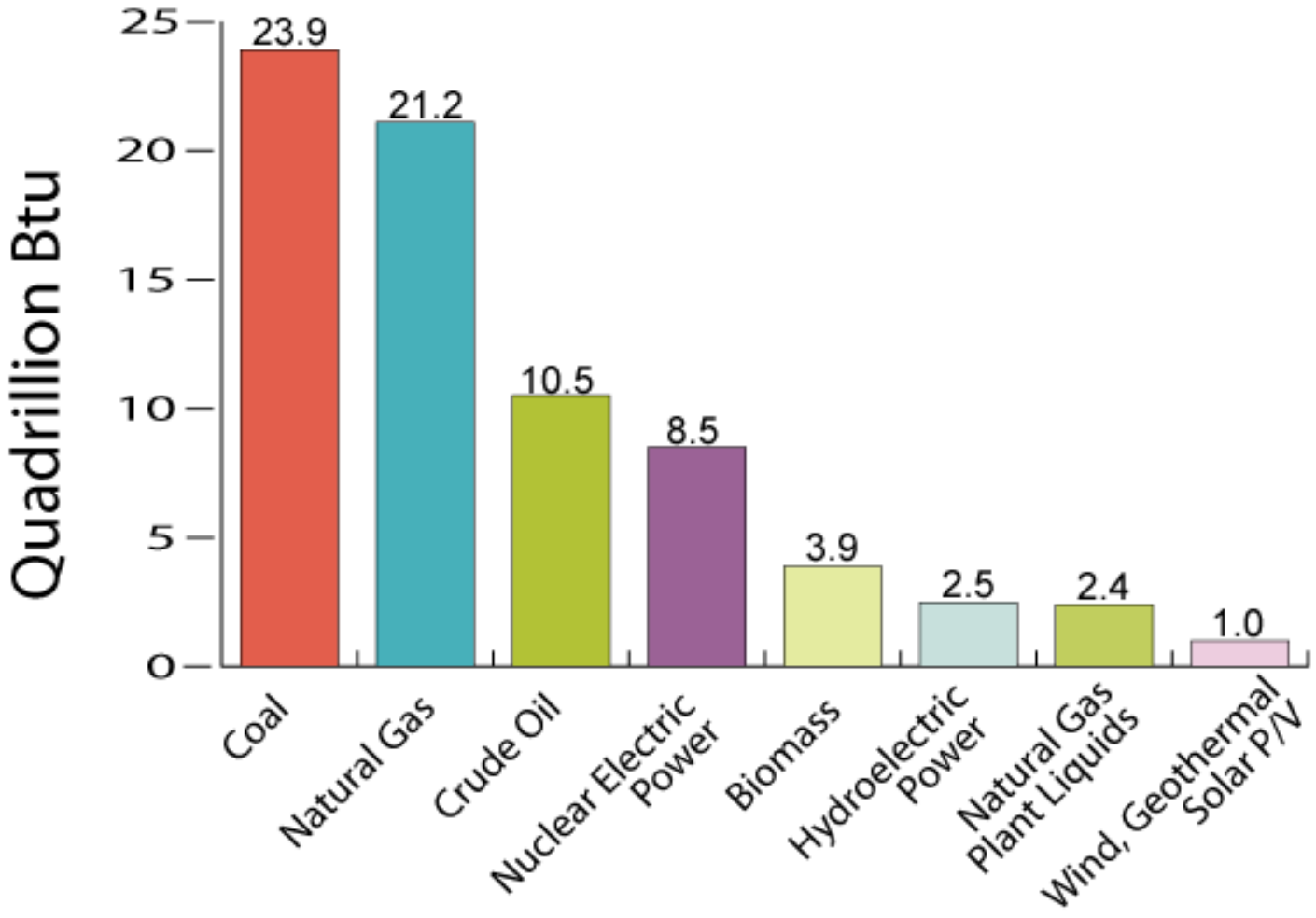
U.S. Primary Energy Consumption by Source and Sector, 2008



Total U.S. Energy = 99.3 Quadrillion Btu

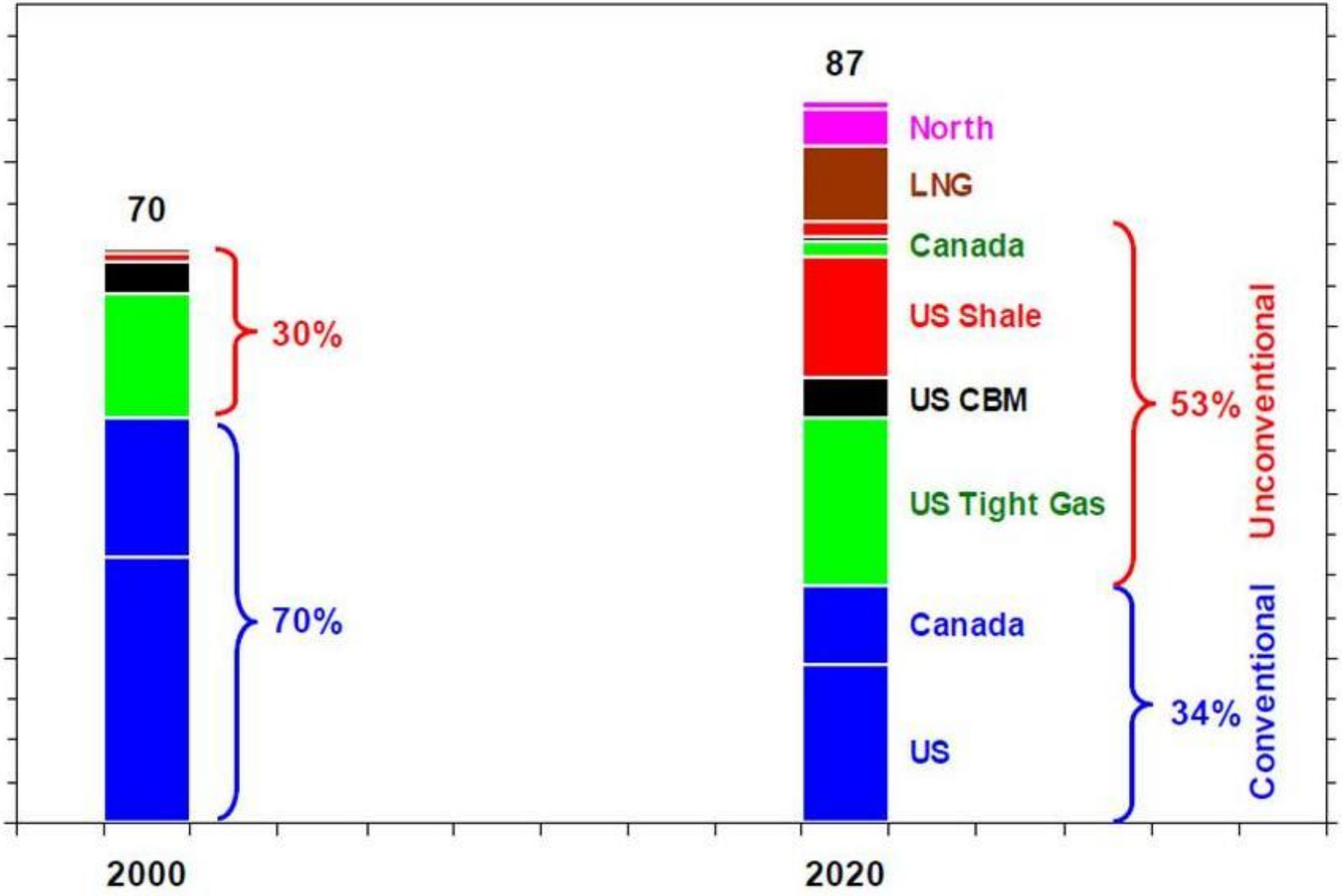
Source: Energy Information Administration, *Annual Energy Review 2008,* Tables 1.3, 2.1b-2.1f.

U.S. Primary Energy Production by Major Source (2008)

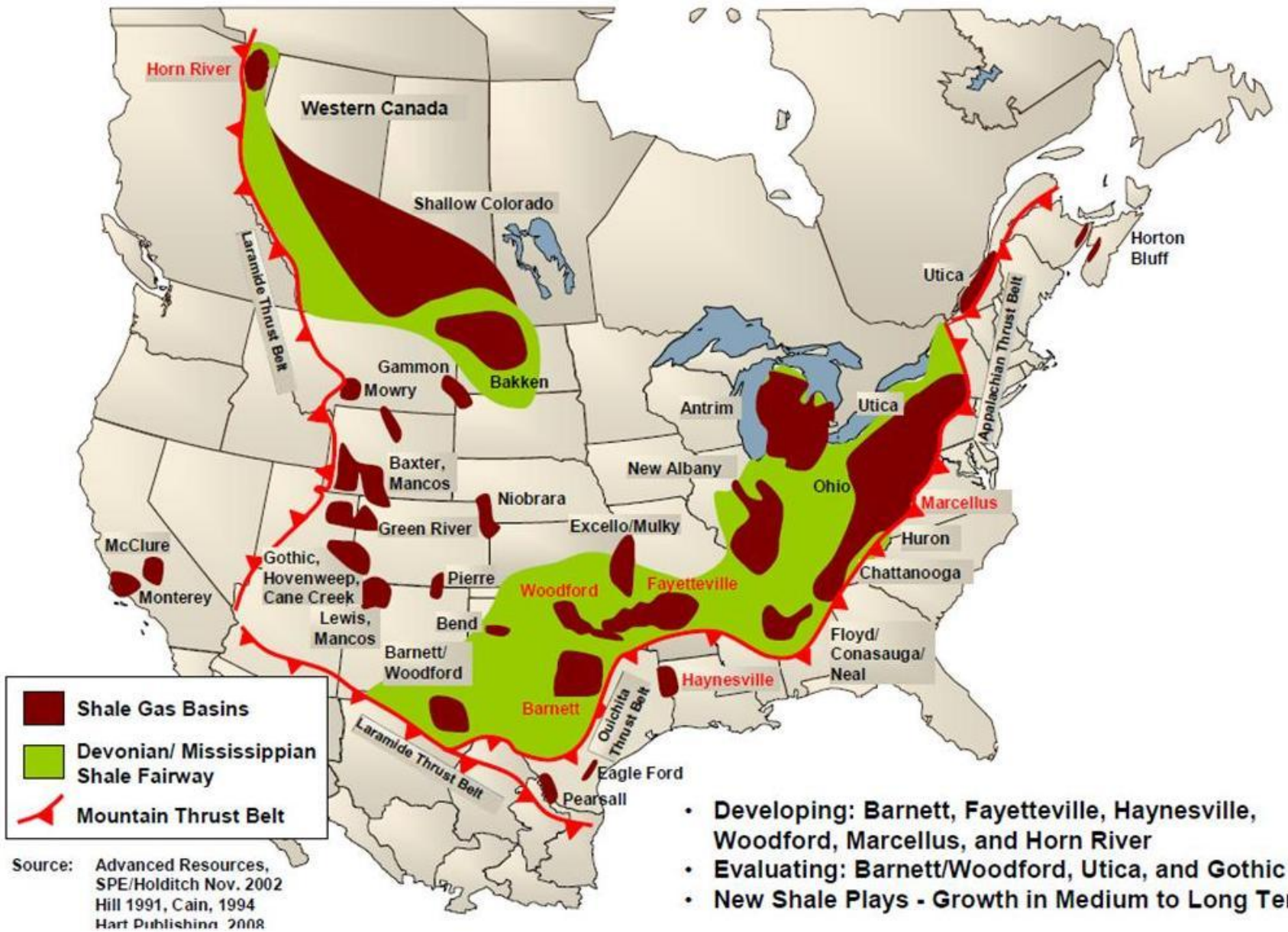


Source: Energy Information Administration, *Annual Energy Review 2008*, Table 1.2. (June 2009)

North American Unconventional Gas Growth, Bcf/d

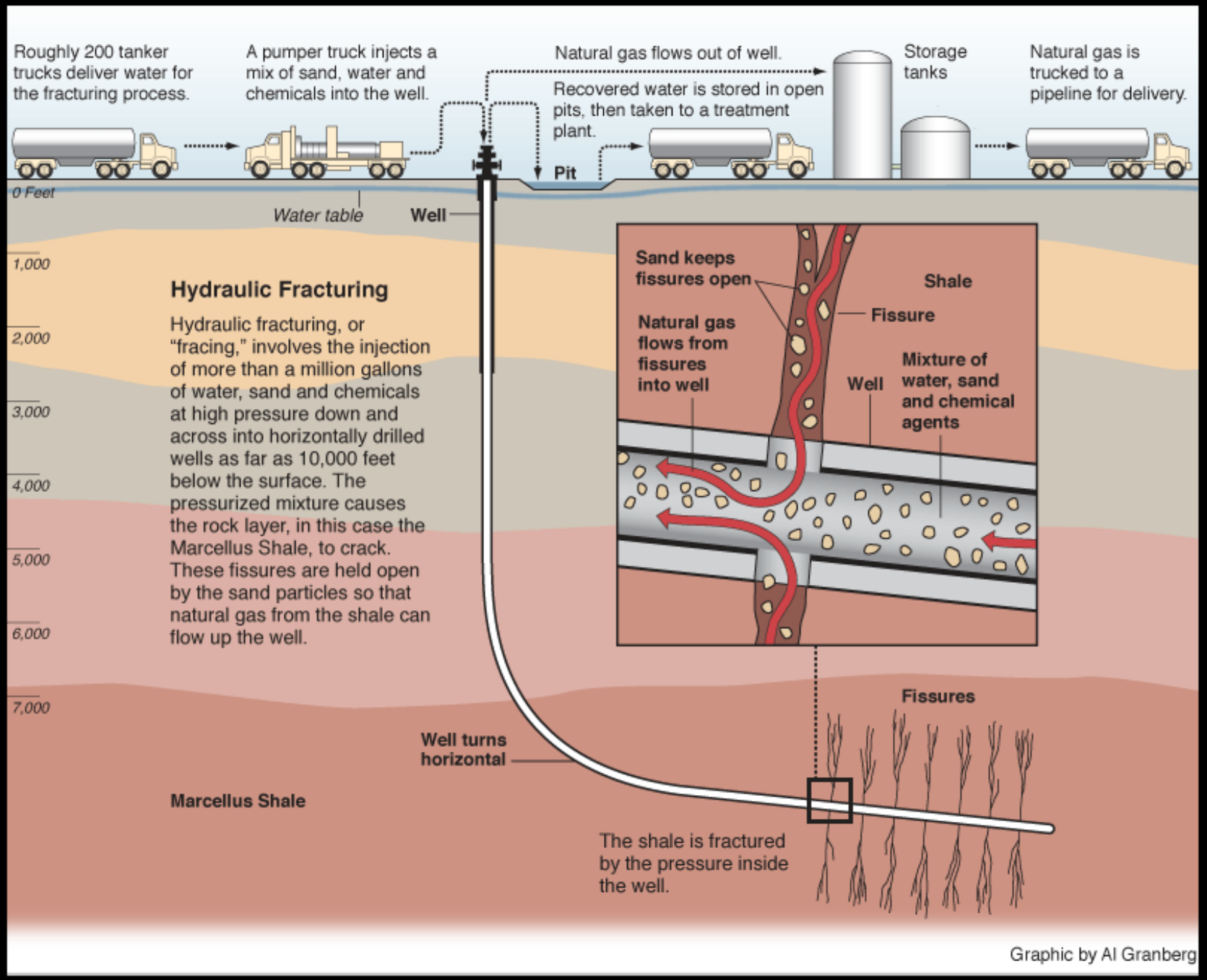


North American Shale Gas Plays

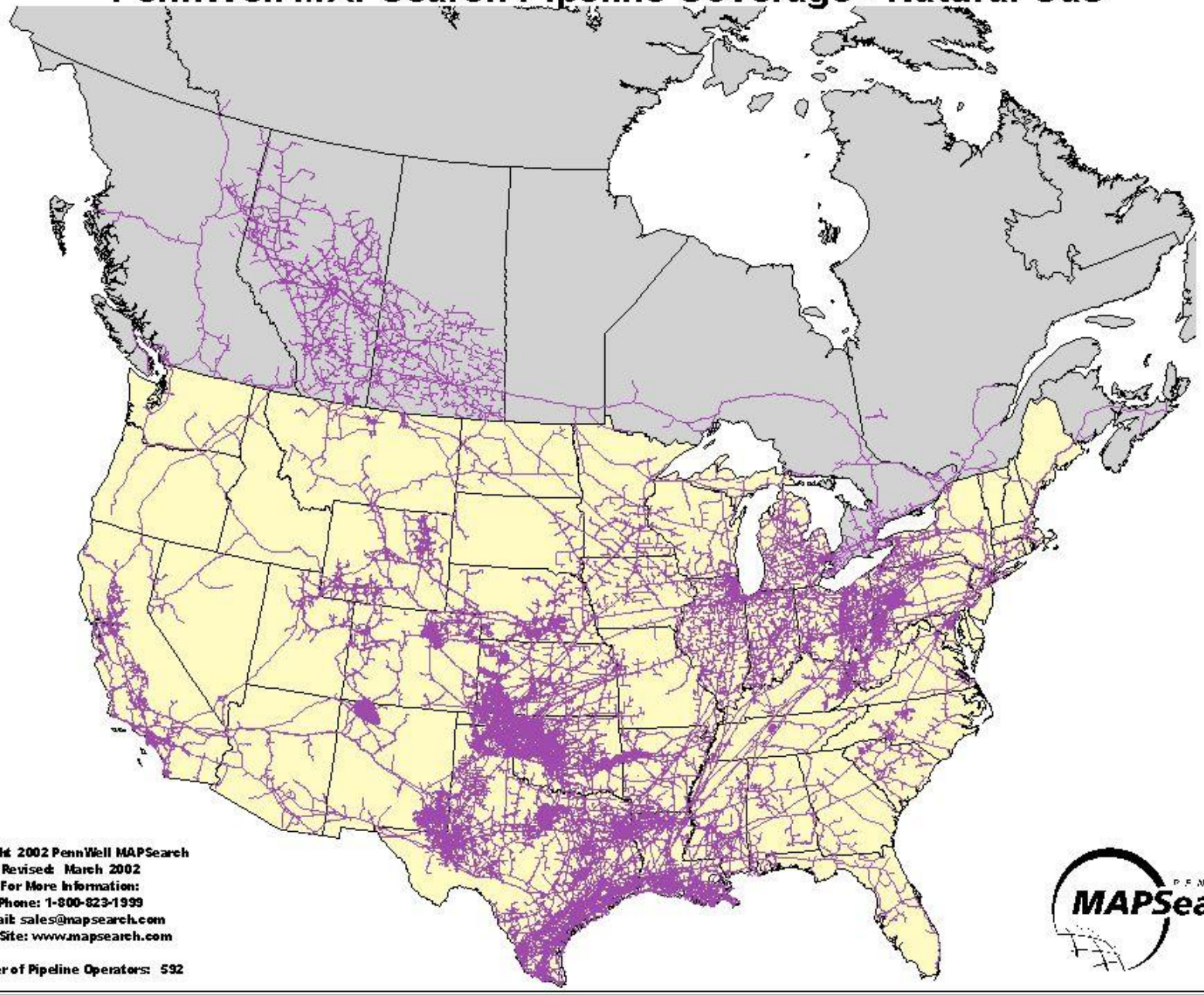


Source: Advanced Resources,
SPE/Holditch Nov. 2002
Hill 1991, Cain, 1994
Hart Publishing, 2008

- Developing: Barnett, Fayetteville, Haynesville, Woodford, Marcellus, and Horn River
- Evaluating: Barnett/Woodford, Utica, and Gothic
- New Shale Plays - Growth in Medium to Long Term


Roughly 200 tanker trucks deliver water for the fracturing process.
A pumper truck injects a mix of sand, water and chemicals into the well.
Natural gas flows out of well.
Recovered water is stored in open pits, then taken to a treatment plant.
Storage tanks
Natural gas is trucked to a pipeline for delivery.
Pit
0 Feet
Water table
Well
1,000
2,000
3,000
4,000
5,000
6,000
7,000
Hydraulic Fracturing
Hydraulic fracturing, or "fracing," involves the injection of more than a million gallons of water, sand and chemicals at high pressure down and across into horizontally drilled wells as far as 10,000 feet below the surface. The pressurized mixture causes the rock layer, in this case the Marcellus Shale, to crack. These fissures are held open by the sand particles so that natural gas from the shale can flow up the well.
Sand keeps fissures open
Shale
Fissure
Natural gas flows from fissures into well
Well
Mixture of water, sand and chemical agents
Fissures
Well turns horizontal
Marcellus Shale
The shale is fractured by the pressure inside the well.
Graphic by Al Granberg

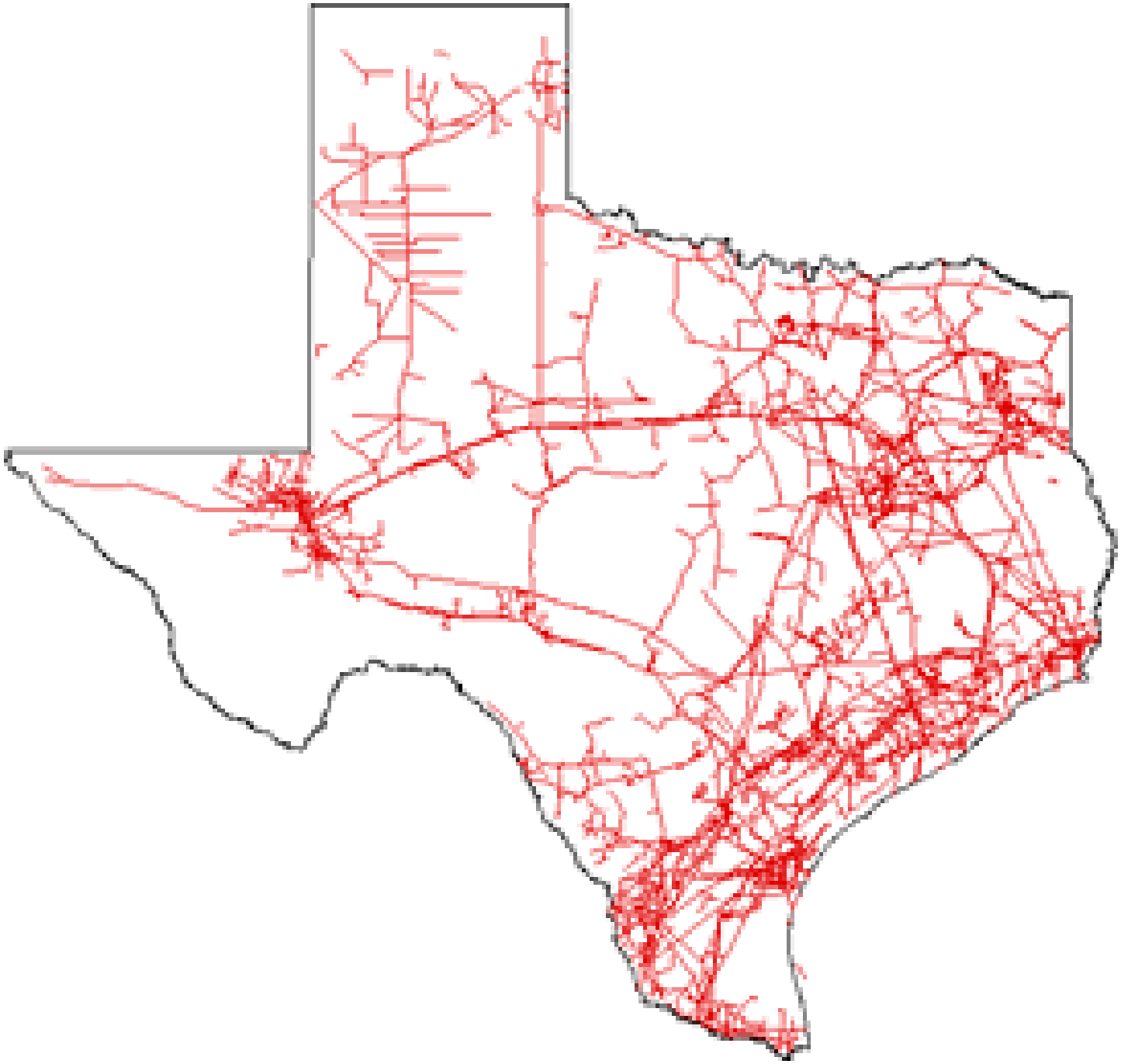
PennWell MAPSearch Pipeline Coverage - Natural Gas



Revised: March 2002
For More Information:
Phone: 1-800-823-1999
E-Mail: sales@mapsearch.com
Web Site: www.mapsearch.com

Number of Pipeline Operators: 592

PENNWELL MAPSearch



The Natural Gas Opportunity Offers A New Long Term Opportunity For Alternative Fuels

- *Shale Gas Removes The Urgency Of Making Alternative Fuels Competitive Immediately Through Governmental Subsidies.*
- *The Current Issue Of The Kiplinger Letter Reported That Congress Is Diverting More Funds From Alternative Energy Projects.*

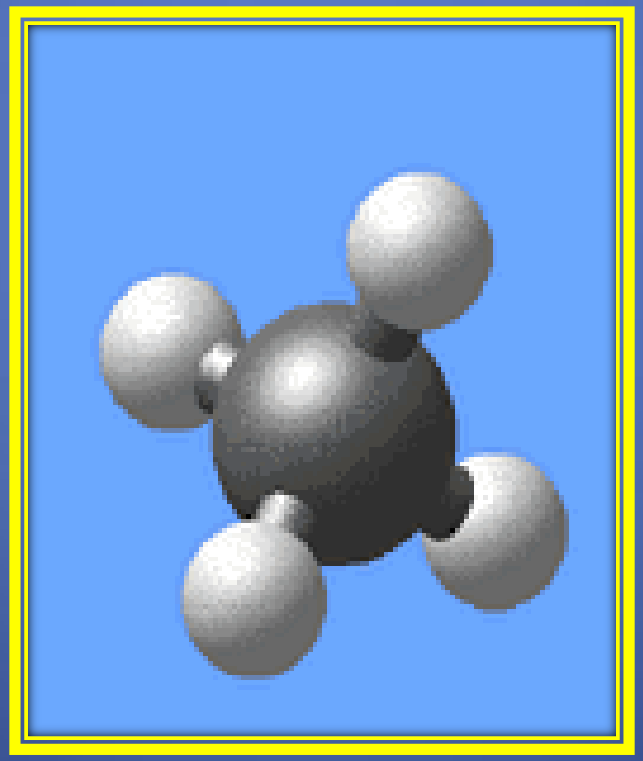
The Natural Gas Opportunity Offers A New Long Term Opportunity For Alternative Fuels

- *These Diverted Funds Are Being Directed To Programs To Help Struggling States Support Medicaid And To Avoid Teacher Layoffs.*
- *The Senate Just Cut $1.5 B More From Funding From Solar, Wind, And Other Renewable Energy Projects. $2 B Was Cut Last Year.*

The Natural Gas Opportunity Offers A New Long Term Opportunity For Alternative Fuels

- *We Can Use Our Natural Gas Now To Buy Some Time For R&D For Alternative Fuels.*
- *This Added Time Will Allow Alternative Fuels To Be More Efficient And Competitive When Natural Gas Supplies Diminish.*
- *Using Our Natural Gas Now Will Also Reduce Our Imported Oil.*

The Natural Gas Opportunity Is NOW!



Bob Patterson

-PBG Energy-

PUBLIC AND PRIVATE NGV DEVELOPMENT

PBG Energy, Inc.

Knoxville, TN (865) 258-9969

pbgenergyinc.com

Why We are Here

- We are promoting Natural Gas as a transportation fuel
- We are partnering with utilities to build public access to CNG fueling stations
- We are creating a network of CNG fueling stations across the state of Tennessee
- We are working with fleets to assess and implement NGVs into their fleets

Natural Gas Facts

- Natural gas is very safe
  - ✓ Lighter than air – dissipates when released
  - ✓ High ignition temperature: 1000F – 1100F
  - ✓ Limited range of air/fuel combustion ratio (5-15%)
  - ✓ Colorless, odorless, non-toxic substance
  - ✓ Doesn't leak into groundwater
  - ✓ Comprehensive fuel tank, vehicle and station design/mfg codes & standards

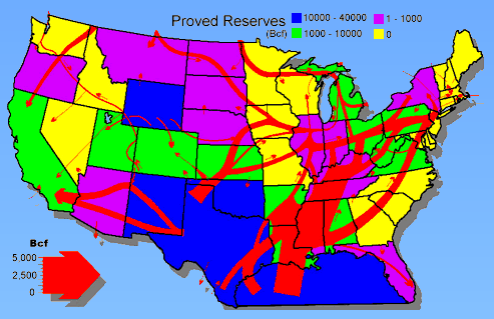
- Natural gas is an inherently clean fuel
  - ✓ Natural gas is mostly methane: one carbon atom, CH_4
  - ✓ Diesel – $C_{14}H_{30}$; Gasoline – C_8H_{18}; Propane – C_3H_8
  - ✓ Less NOx, soot and greenhouse gases than petroleum fuels

Natural Gas Facts

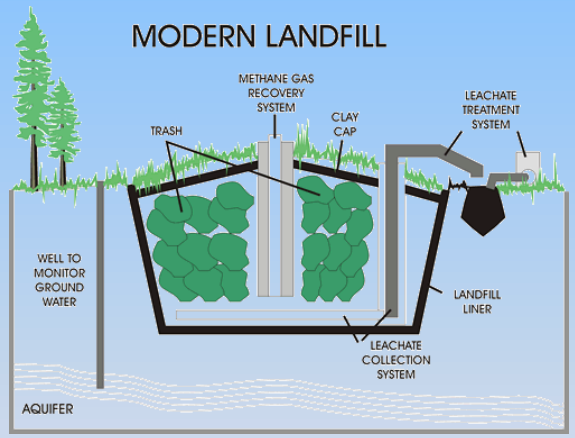
- Natural Gas Vehicles are proven and reliable
- Over ten million NGVs in use worldwide
- Gas utilities have been operating NGVs for decades
- NGVs produce between 93-95% fewer overall toxics and reduces greenhouse gas emissions by 23-29% compared with diesel- and gasoline-fueled vehicles

Natural Gas Facts

- **Natural gas is an abundant domestic fuel**
  - ✓ 98+% from North America
  - ✓ Well-developed distribution infrastructure
  - ✓ With shale gas discoveries, our supply is estimated at 120 years!



- **Growing interest in renewable bio-methane**
  - ✓ Landfills, sewage, animal/agri-waste
  - ✓ Energy crops – R&D into cellulosic biogas
  - ✓ The United States could produce the equivalent of 10 billion gallons of gasoline annually from renewable natural gas (bio-methane)



Bio-Methane in East Tennessee

PBG Energy, Inc. has a contract for development of a public CNG fueling station with a utility that currently receives 200 - 400 dkt per day of bio-methane from the local landfill.

At 300 dkt per day, this supply could fuel **1,000 vehicles** per day, assuming vehicle averages of 18,000 miles per year at 20 mpg.

Bio-methane is a resource available, today. We can use our current natural gas production and infrastructure as we increase our bio-methane production.

Vehicle Considerations

Target NGV Applications

- Municipal Vehicles
- School Buses
- Refuse Trucks
- Transit Vehicles
- Delivery Fleets
- Service Fleets
- Utilities other than Gas
- Any Return Trip Vehicle

Available OEM NGVs

For the seventh straight year, the Civic GX NGV was named "Greenest Vehicle" by the American Council for an Energy Efficient Economy (ACEEE).

- General Motors is offering NGVs late in 2010
- Ford announced a return to NGVs by 2012
- Others expected to enter the U.S. NGV market

Certified Vehicle Conversions
Another Option to OEM

There are two types of conversions:

- Dedicated Conversion Vehicle runs on CNG only

- Bi-Fuel or Dual-Fuel Conversion Vehicle runs on either CNG or gasoline

Each conversion must meet stringent EPA and/or California Air Resources Board (CARB) requirements.










odwalla




CELEBREZZE



Coca-Cola



PENSKE










Station Considerations

Natural Gas Fuel Station Types

- Time-fill
  CNG is dispensed slowly directly to vehicles' onboard storage tanks. Lower cost station. Best for fleets that return to central lot and sit idle overnight or extended periods and do not need fast fill capability.

- Fast-fill
  similar to liquid fueling station, same fill rates and times. A MUST for public access. Also good for larger fleets where fueling turn-around time is short.

- Combo-fill capability
  Comprises both time-fill and fast-fill. Often good for fleets that can fuel on time-fill but need occasional "top off" or want/need ability to provide public access

Natural Gas Fuel Station Considerations

- Private or Public
- On-site or Off-site
- Maximum daily and hourly fuel usage
- Fueling station site requirements
- Dispensers and fuel management
- Start phase versus final design


Economic Advantages and
Examples for Tennessee

CNG Stakeholders

CNG Stakeholders

- Natural Gas Supply
- Initial Infrastructure
- NGV Rate
- Backup to Onsite

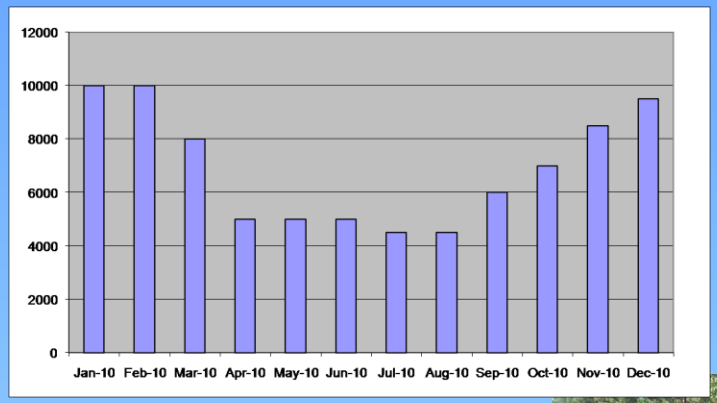
- Vehicle Commitment
- May Own Onsite Station

- Station Load Analysis
- Station Sizing
- Construction
- Manage and Maintenance
- Vehicle Conversion

CNG Stakeholders Benefits

Utility

- Year Round Load
- Even Load Profile
- Uses unused capacity
- Rate Stability
- Lowers Cost of Fuel



Fleet Customer

- Lowers Cost of Fuel
- Less Fluctuation in Pricing
- Lower Maintenance Costs
- Cleaner Air
- Health Benefits

CNG Suppliers

- Job Creation
- Equipment Provider
- Construction
- Manage
- Maintenance
- Vehicle Conversion

Components of CNG Cost

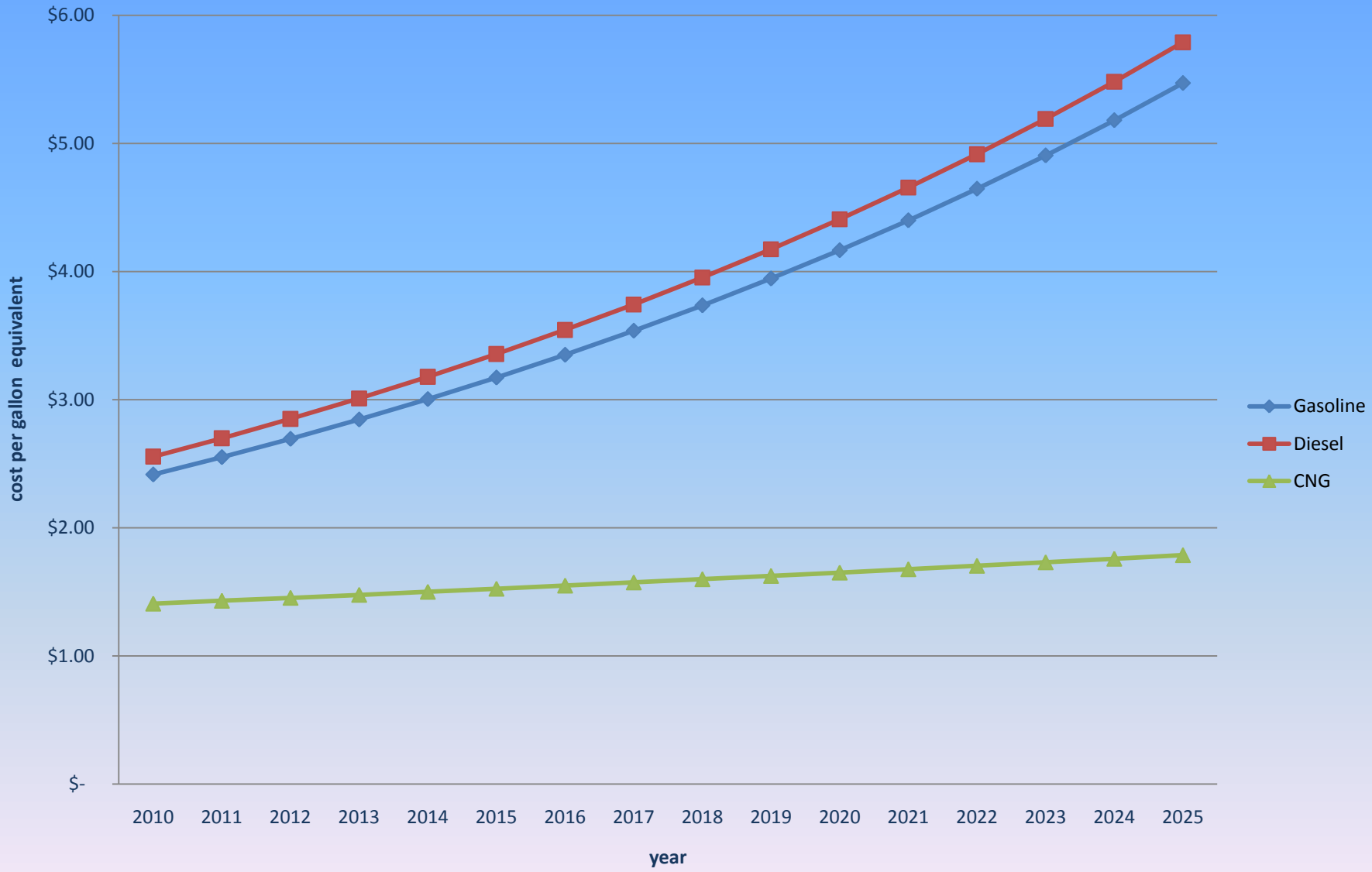
- One GGE (Gasoline Gallon Equivalent) = one gallon of gasoline
- One cubic foot = ~1000 BTUs (note: cf = volume, BTU = energy)
- One therm = 100,000 BTUs (~100cf)
- One MCF = 1000 cubic feet
- One MCF = 1000 x 1000 = ~1,000,000BTUs (MMBTU or decatherm)
- 124,800 BTU = 1 GGE
- One MCF (DKT) = roughly 8 GGE of natural gas.
- Price per DKT x 0.125 = price per GGE

Federal Tax Incentives and Credits

- Income tax credit to the buyer of a “new” dedicated alternative fuel vehicle
- One time credit (for buyer) equal to 50% of the cost of CNG or LNG fueling equipment, up to $50,000
- Volumetric Excise tax credit on alternative fuels is $0.50 per gasoline gallon equivalent of CNG
- Grants are available from federal and state agencies

U.S. Energy Information Administration

(statistical and anylitical agency within DOE)



CNG Price at Fueling Station

$	10.00	Natural Gas per dkt
$	1.25	per gge natural gas
$	0.50	station M & O cost
$	1.75	per gge cng

non taxable entity

$	1.75	per gge cng
$	(0.50)	rebate per gge
$	**1.25**	**per gge CNG**

taxable entity

$	1.75	per gge cng
$	(0.50)	rebate per gge
$	1.25	per gge cng
$	0.18	fed
$	0.13	state
$	**1.56**	**per gge CNG**

CNG versus Gasoline

Gasoline retail price	$ 2.62	$ 75 per barrel
Natural gas commodity	$ 1.25 GGE	$ 10.00 per dkt
Station M&O cost	$ 0.50 GGE	
	$ 1.75	
Tax exempt	$ 1.75	
Tax credit (federal)	$ (0.50)	Gasoline / Savings
(LDC)	**$ 1.25**	**$ 2.60** / **$ 1.35**
Taxable	$ 1.75	
Tax credit (federal) net	$ (0.50)	
Tax (Federal excise)	$ 0.18	
Tax (Tennessee fuel)	$ 0.13	Gasoline / Savings
	$ 1.56	**$ 2.60** / **$ 1.04**

Gasoline retail price	$ 3.59	$100 per barrel
Natural gas commodity	$ 1.25 GGE	$ 10.00 per dkt
Station M&O cost	$ 0.50 GGE	
	$ 1.75	
Tax exempt	$ 1.75	
Tax credit (federal)	$ (0.50)	Gasoline / Savings
(LDC)	**$ 1.25**	**$ 3.59** / **$ 2.34**
Taxable	$ 1.75	
Tax credit (federal) net	$ (0.50)	
Tax (Federal excise)	$ 0.18	
Tax (Tennessee fuel)	$ 0.13	Gasoline / Savings
	$ 1.56	**$ 3.59** / **$ 2.03**

Fleet Vehicle Scenario

Example 1

250 GGE/Day Fueling Station

	Utility trucks	Utility cars	Fleet LDV	Fleet Refuse	Fleet buses	School Buses	Total	
vehicles	10	20	25	0	0	0	55	vehicles

Fleet Vehicle Scenario

Example 1

250 GGE/Day Fueling Station

	Utility trucks	Utility cars	Fleet LDV	Fleet Refuse	Fleet buses	School Buses	Total	
vehicles	10	20	25	0	0	0	55	vehicles
miles per year	18,000.0	20,000	18,000					
miles per day	69	77	60					
mpg	10	20	15					
working days per year	260	260	300					
gallons per year	1,800	1,000	1,200					
total gallons per day	69.2	76.9	100.0				246.2	total gallons per day

cont'd

Fleet Vehicle Scenario

Example 2

250 GGE/Day Fueling Station

	Utility trucks	Utility cars	Fleet LDV	Fleet Refuse	Fleet buses	School Buses	Total	
vehicles	1	1	1	8	0	0	11	vehicles

Fleet Vehicle Scenario

Example 2

250 GGE/Day Fueling Station

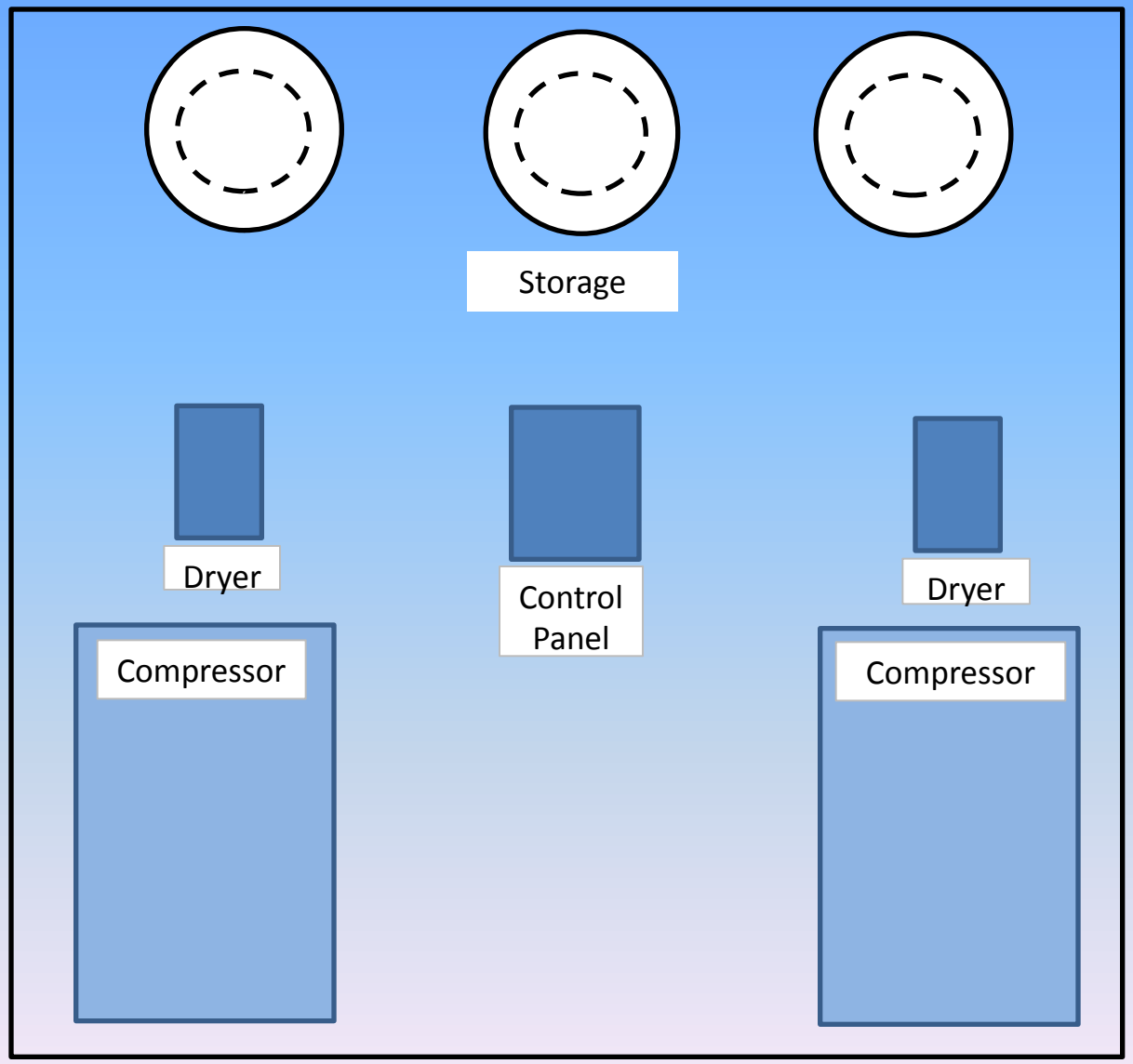
	Utility trucks	Utility cars	Fleet LDV	Fleet Refuse	Fleet buses	School Buses	Total	
vehicles	1	1	1	8	0	0	11	vehicles
miles per year	18,000	20,000	18,000	25,000				
miles per day	69	77	60	83				
mpg	10	20	15	2.8				
working days per year	260	260	300	300				
gallons per year	1,800	1,000	1,200	8,929				
total gallons per day	6.9	3.8	4.0	238.1			252.9	total gallons per day

cont'd

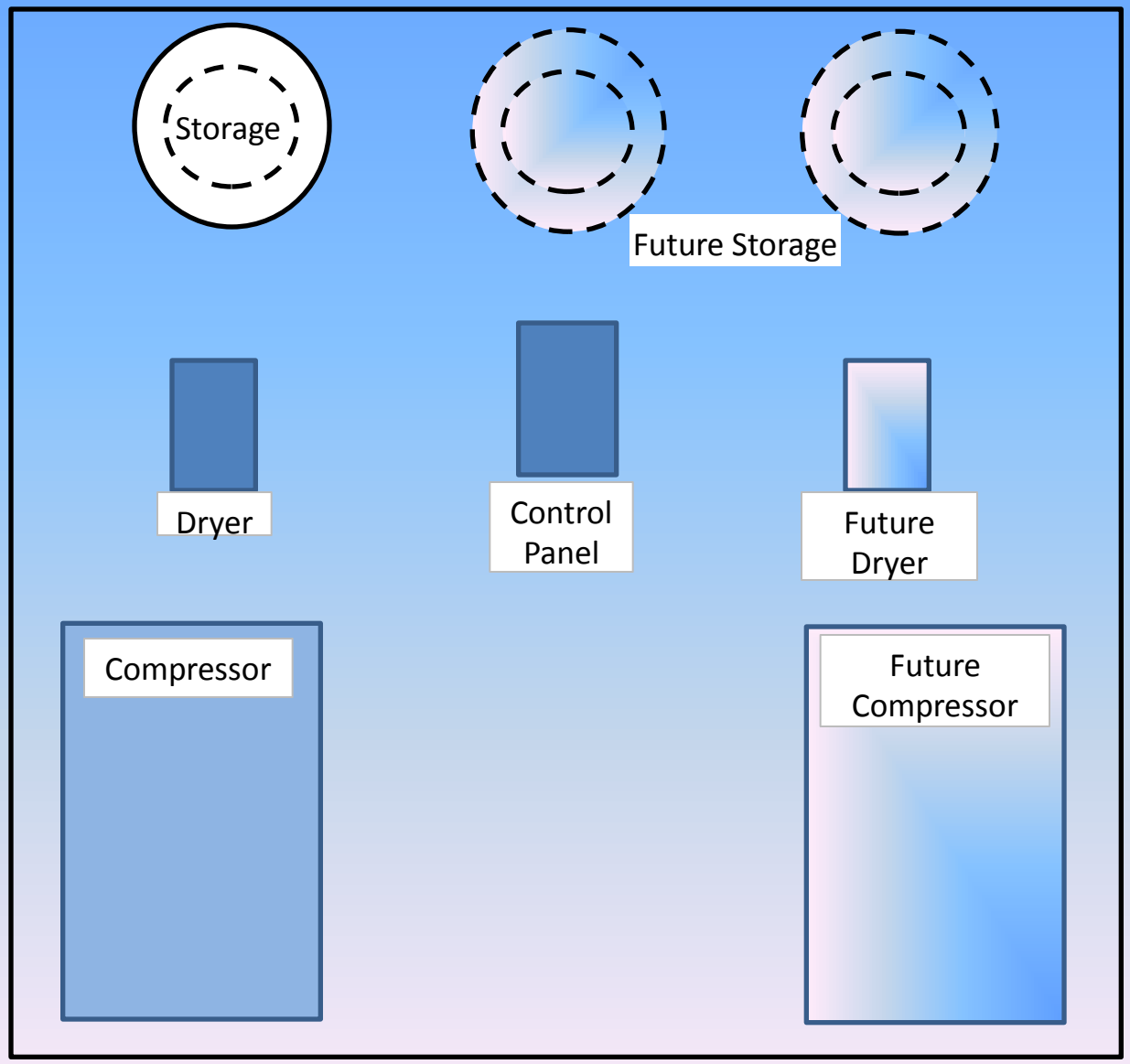
Station Sizing

Compressor	20	to	28	SCFM
Equals approx	10	to	14	GGE per hour
Run Time	10	to	12	hours per day optimum
Output	100	to	168	GGE per day
X 2 compressors	200	to	336	GGE per day

Modular Station Design and Growth



Modular Station Design and Growth



Fleet Time Fill Station

Cargo Van for Contractor

- GVWR >8,500 and < 14,000 lbs.
  - Ford E-350 Cargo Van
  - Chevy/GMC 3500 Cargo Van
- MPG: 13/15 City/Hwy, 35K miles/yr
- Fuel Use: 8-10 GGE/day, 2700-3100GGE/yr
- CNG Premium: $15,000
  (before fed tax credit)
- Fed Tax Credit: $8000 (>8500 < 14000 #)
- Remaining premium (assuming no grant): $7000
- Simple Payback: 1.3-1.6 years
- Life –cycle cost advantage: $15,200-$19,200
  (based on 5 yr life and $1.65GGE savings at "O&O" station)

Economics of a 12 vehicle Fleet Time-Fill
Taxable

$	100,000	Fueling Station Cost
$	(50,000)	Tax Credit
$	50,000.00	Net Station Cost
	12	Vehicles
	35,000	avg miles per year
	10	Avg MPG
	3,500	annual gge per vehicle
	42,000	Annual gge per year fleet
$	1.65	Savings per gal over gasoline
$	63,900	Fleet Annual Savings
	0.7	**Yrs Simple Payback on Station Cost**

Economics of a 12 vehicle Fleet Time-Fill
Non-Taxable

$	100,000	Fueling Station Cost
$	0	Tax Credit
$	100,000.00	Net Station Cost
	12	Vehicles
	35,000	avg miles per year
	10	Avg MPG
	3,500	annual gge per vehicle
	42,000	Annual gge per year fleet
$	1.65	Savings per gal over gasoline
$	63,900	Fleet Annual Savings
	1.4	**Yrs Simple Payback on Station Cost**

Vehicle Considerations

Light Duty Vehicle Fleet

- 15 Vehicle Fleet
- 13-15 Average MPG
- 50,000 Average Miles per Year/Vehicle
- 50,000-57,700 Gallons of Fuel per Year
- $82,500-$95,200 Savings/year (based on $1.65 savings with CNG)

Savings over 5 year lifespan

(assuming no grant)

$232,500 – $296,000 Savings No Tax Credit

$292,500 – $356,000 Savings with Tax Credit

Light Duty Vehicle Fleet

- 15 Vehicle Fleet
- 14 Average MPG
- 50,000 Average Miles per Year
- 52,500 Gallons of Fuel per Year
- 6,563 Dekatherms per Year

6,563 Dekatherms per Year
÷ 65 Dekatherms per Home
= 101 Homes

A 15 Vehicle Fleet Equals 101 Homes

Refuse Truck Fleet

- 10 Vehicle Fleet
- 2.5-3 Average MPG
- 25,000 Average Miles per Year/Vehicle
- 83,000-100,000 Gallons of Fuel per Year
- $137,500-$165,000 Savings/year (based on $1.65 savings with CNG)

Savings over 8 year lifespan

(assuming no grant)

$600,000 – $820,000 Savings No Tax Credit

$920,000 – $1,140,000 Savings with Tax Credit

Refuse Truck Fleet

- 10 Vehicle Fleet
- 2.5 Average MPG
- 25,000 Average Miles per Year
- 100,000 Gallons of Fuel per Year
- 12,500 Dekatherms per Year

12,500 Dekatherms per Year
÷ 65 Average Dekatherms per Home
= 192 Homes

A 10 Vehicle Fleet Equals 192 Homes

Fleet NGV Development

Obstacles

- No offsite public stations typically available.
- Small to midsized fleets not large enough for independent developers to invest in station for customer.
- Initial fuel use not sufficient for economical transition to NGV's.
- Back-up to fueling station for reliability not economical.
- No experience with natural gas or fueling stations.

Fleet NGV Development

PBG Energy Solutions

- Public-Private partnership with utility provides off-site public fueling available to fleets.
- Provides a fast fill option to back up a lower cost time fill fleet operation.
- Provides reliability by insuring natural gas availability.
- Provides experienced operation and management of facility.

Next Steps

Get Started!

Benefits:

- Even a small start in NGV's will provide real world experience in savings and reduced maintenance cost.
- Utilize success with initial fuel savings and green initiative goals to seek out tax credits and/or grants to expand NGV fleet.
- PBG Energy Inc. will provide assistance in order to facilitate successful natural gas vehicle programs.

Conclusions

- Natural Gas is a Clean, Domestic, and Economical transportation fuel
- Tax incentives and grants are available for transitioning to NGVs
- Natural gas is plentiful and is easily utilized to displace foreign oil
- Renewable Natural Gas (Bio-methane) is viable and currently available
- We can transition to more renewable sources for gas and add them to our current natural gas distribution and CNG infrastructure
- The economics of CNG are very favorable to forge alliances between fleets and end users and natural gas distribution companies (gas utilities)

Thanks For Your Time and Interest

Contact:

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pspurlin@pbgenergyinc.com

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AGA.org
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